1,076,315

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Crank Driven Switching Mechanisms

We, ROBERT BOSCH GMBH, a German Company of 4, Breitscheidstrasse, Stuttgart-W, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a switching mechanism for accomplishing switching operation movements, and comprising a crank, a switching element and a connecting linkage connecting the crank to the switching element. Such switching operations may, for example, be gear-changing operations in the gear box of a mechanically propelled vehicle.

Switching mechanisms are already known in which the connecting linkage comprises a connecting rod guided in a guide block or in a rotatable longitudinal guide. The movements produced by these mechanisms were hitherto only rectilinear, arc shaped or of elliptical form.

An object of the present invention is to provide a switching mechanism in which the switching element is capable of accomplishing one after another several forms of movement, that is, similar to the path which is required in changing gear in a gearbox with an H gear-change movement.

In accordance with the present invention the connecting linkage comprises a resiliently flexible connecting rod which is guided at its end connected to the switching element by switching gate slots contained in a fixed guide and at its middle region by a slide bearing mounted at least approximately in a plane through the crank axis and one of the gate slots. The prescribed switching path is traversed by the switch element through the gate slots when the crank rotates, during which, according to the direction of the straight portion of the part of the path traversed by the switching element, the connecting rod is bent to a greater or lesser extent and releases the energy stored in it due to bending in traversing a portion of path approximately perpendicular to the longitudinal axis of the connecting rod.

For producing this kind of compound movement, devices have hitherto been known which have two straight line acting motors arranged at right angles to each other and controlled according to the desired shape of the path of movement. With respect to these the switching mechanism in accordance with the invention offers the advantage that only a single actuating motor is required. Also these known devices have the disadvantage that in switching movements which are composed of part movements at right angles to each other, the frequent acceleration and braking of the individual motors is necessary, whereas with the device in accordance with the invention the change of the direction of movement is very rapidly obtained by the progressively stored spring energy of the flexible connecting rod.

A further advantage of the switching mechanism of the invention is the simple selection of the switching path for the switching element given by the gate slots, since according to the direction of rotation initiated in the crank the switching element will be guided through the various switching gate slots.

The invention will be further described, by way of example, with reference to the accompanying drawings in which:—

Fig. 1 is a schematic elevation of a switching mechanism provided on a vehicle gearbox and constructed in accordance with the invention;

Fig. 2 is a plan view, on the plane II—II of Fig. 1 of the switching mechanism;

Fig. 3 is a plan view of an interlocking guide of the mechanism;

Figs. 4 to 7 illustrate the sequence of movements of the change-speed gear box schematically.

The switching mechanism illustrated in the drawings serves for the accomplishment of the gear change movements on an automobile gearbox 5 of normal design with an H gear change sequence for four forward speeds and

a side branch for one reverse gear. The individual gear positions are indicated by the numbers 1 to 4 and R corresponding to the speeds on a fixed guide or corlisse 6. Corresponding to the gear positions of the gear box the guide 6 has gate slots in which the gear-change member in the form of a gear change lever 7 is guided.

The gear-change lever 7 is connected to the end of a connecting rod 8 of the switching mechanism for effecting the gear-change movements of the lever 7. The other end of the connecting rod 8 is pivoted to a crank 9 which is set into rotation by a reduction gear drive 10, 11 by a reversible motor 12. The radius of the crank 9 corresponds to about half the gear change stroke between two opposite speed positions of the gear-change lever 7. In order to impart a definite form of movement to the gear-change lever 7, a slide bearing 13 guiding the connecting rod 8, is arranged at least approximately in a plane through the crank axis and one of the gate slots in the guide 6. Since the form of movement imparted to the connecting rod end by the crank 9 and this sliding bearing would coincide only approximately with the gear change path of the gear change lever 7 determined by the guide 6 the connecting rod 8 is made resiliently flexible so that the movement created by the crank is accommodated to the gear-change path of the gear-change lever 7 which is guided in restraint.

The connecting rod 8 is conveniently a flat spring with two articulating heads 14 and 15 attached to its ends. In order to avoid shocks on changing gear, the linkage head 15 is resiliently connected to the flat spring connecting rod 8 by a helical spring 16.

The operation of the above described switching mechanism is as follows:—

For each gear change movement, the crank 9 is rotated in one or other direction by the motor 12, which is electrically, pneumatically or hydraulically controlled, through half a revolution towards or away form the guide 6. The initiation of the rotary movement is controlled, in conjunction with a clutch (not shown), by the driver or by the gearbox driving device semi or fully-automatically, while the termination of the movement is controlled by switch elements (not shown) such as limit switches, suitably mounted at the ends of the gear change gate slots in the guide 6. The direction of rotation initiated in the crank 9, which determines the selection of, at times, two possible gear change gate slots by the connecting rod end 15 or of the gear-change lever 7 connected thereto, is one of the utmost importance for a gear change process.

Assuming that the gear box 5 has to be changed up from first to second gear (Fig. 4) the gear-change lever 7 has therefore to perform a straight line movement from left to right. This is accomplished by the crank 9 making half a turn in a clockwise direction. During its movement the gear-change lever 7 is thereby pressed against the lower boundary of the gear change gate slot between 1 and 2 so that the connecting rod 8 is bent downwards, for a short time until the gear position 2 is reached.

In order that, with a gear box with an H change sequence and a side gate slot for reverse gear, the latter side gate slot is blocked for forward speeds, a blocking device is fitted on the switch guide 6 and comprises a plate pivotable between two end positions, and an adjusting motor 18. The plate 17 has two joined apertures 19 and 20 of which the aperture 19 has the shape of a rectangle the corners of which are located by the end positions of the gear-change lever 7 in the gear positions 1 to 4, while the aperture 20 has the shape of the gear change gate slot for the gear-change lever 7 from 1st gear to reverse. According to the position of the plate 17 a change is only possible in the forward speeds or between 1st gear and reverse. It is self evident that the blocking device is not necessary for gear boxes with only 4 speeds arranged in H sequence.

The change from 1st gear to reverse is shown in Fig. 7. Here the plate 17 of the blocking device is rotated so that the tongue formed between the two apertures 19 and 20 shuts off the gear change gate slots to 2nd to 4th gears. By half a turn of the crank 9 in a clockwise direction the gear-change lever 7 is guided in a path comprised of three relatively perpendicular parts connected together from 1st gear to reverse. In doing so the connecting rod 8 in the first part of its movement is bent until the gear change gate slot turns downwards at right angles. Here the connecting rod 8 relaxes itself because the gear-change lever 7 presses downwards into this gear-change gate slot in order to achieve a right angle change of direction. The gear change out of reverse into 1st gear takes place in a similar manner as described, in which the crank is again driven in a clockwise direction.

The changes from 2nd gear to 4th gear, which are illustrated in Figs. 5 and 6, take place in a similar manner. The crank 9 when changing from 2nd gear to 3rd gear makes a clockwise half turn as shown in Fig. 5 and from 3rd gear to 4th gear an anticlockwise half turn as shown in Fig. 6. The change down from a higher to a lower gear is in general carried out, to obtain a rectilinear movement of the gear-change lever 7, with a direction of rotation of the crank 9 which is opposite to that required for that of changing up and, for a combined, angled movement of the gear-change lever 7, with the same direction of rotation of the crank 9 as for changing up.

The change into neutral of the gear box is carried out by a quarter turn of the crank

9 so that the gearchange lever 7 comes to about half way between the gates for 1st, 3rd and 2nd, 4th gears. The control for this is carried out, for example, by switch elements suitably fitted in the path of rotation of the crank.

An electric motor with a permanent magnetic field is used by preference for driving the crank 9 so that on reaching a given gear position a more rapid arresting of the motion occurs by short circuiting the armature.

Finally it should be noted that a switching mechanism constructed in accordance with the invention can also be applied with great advantage to the accomplishment of similar switching or working movements to those described above which take place either in at random or in a regular uninterrupted manner.

WHAT WE CLAIM IS:—

1. A switching mechanism for accomplishing switching movements and comprising a crank, a switching element, a resiliently flexible connecting rod connecting the crank to the switching element, a fixed guide containing switching gate slots guiding the end of the connecting rod connected to the switching element and a slide bearing arranged at least approximately in a plane through the crank axis and one of the gate slots to guide the middle region of the connecting rod.

2. A switching mechanism as claimed in claim 1, in which the connecting rod comprises a flat spring with articulating heads at its ends.

3. A switching mechanism as claimed in claim 1 or 2 in which the connecting rod has a resilient element acting in its longitudinal direction.

4. A switching mechanism as claimed in claim 1, 2 or 3, in which the gate slots in guide plate are of H form.

5. A switching mechanism as claimed in claim 4, in which the guide plate is provided with a further side branch gate slot, and a movable blocking device is provided for the branch gate slot.

6. A switching mechanism as claimed in claim 5, in which the blocking device is a plate with two interconnected apertures which generally correspond to the shapes of the H form gate slots and the branch gate slot.

7. A switching mechanism as claimed in any preceding claim in which limit switches for the crank drive are provided at the ends of the gate slots.

8. A switching mechanism as claimed in any preceding claim in which a reversible motor with a permanent magnetic field is provided for rotating the crank.

9. A switching mechanism constructed and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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Chartered Patent Agents.

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from which copies may be obtained.

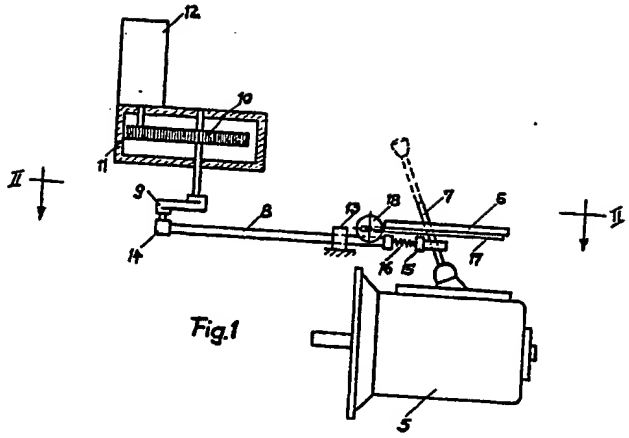

Fig.1

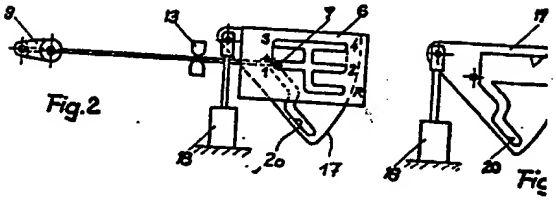

Fig.2

Fig

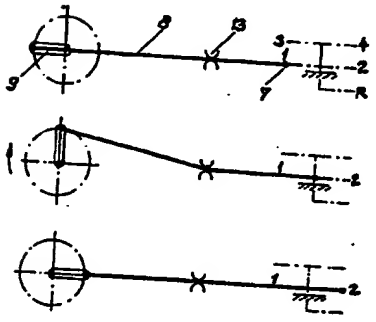

Fig.4

1076315 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

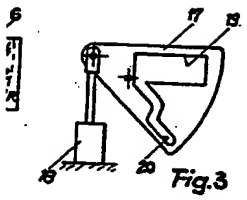

Fig.3

Fig.4

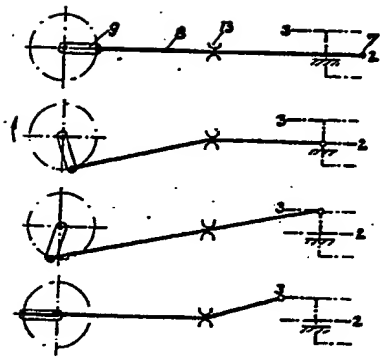

Fig.5

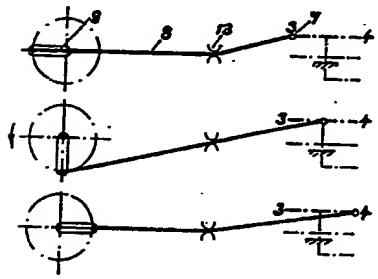

Fig.6

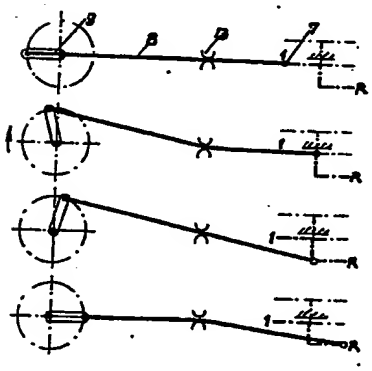

Fig.7

1076315 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

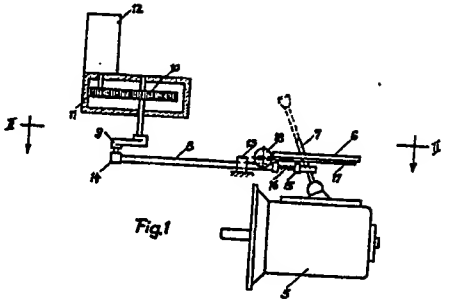

Fig.1

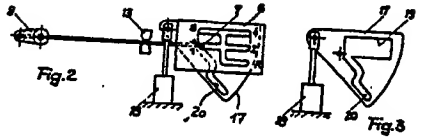

Fig.2

Fig.3

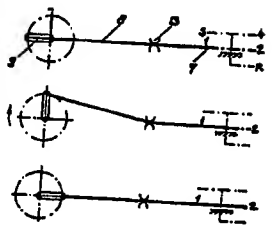

Fig.4

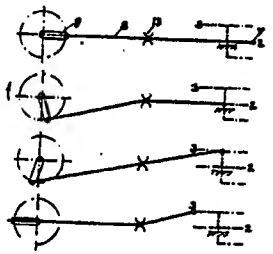

Fig.5

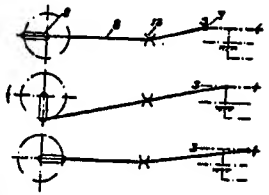

Fig.6

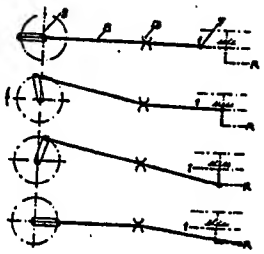

Fig.7